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ABSTRACT

A survey of undergraduate education methods texts indicates that students are repeatedly exposed to the theories of Jean Piaget, with an emphasis on the stages of development and characteristics of preschool children. The suggestion is made that an evaluation should be undertaken of misconceptions that undergraduate students might develop as a result of an incomplete understanding of selected human development theories. Inappropriate practices are pointed out which have developed as a result of the exposure of preschool education students' to the theories of Piaget. The results of a study of the analogical reasoning ability of four- and five-year olds adds to the neo-Piagetian literature by demonstrating the analogical reasoning ability of these children. It is suggested that a broader base of conceptual understanding of cognitive functioning is needed by teachers of young children. (JD)

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RETHINKING PIAGET: IMPLICATIONS FOR TEACHER EDUCATION

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Jean Piaget, a Swiss psychologist, observed children for over 60 years. The information he collected formed a theory of cognitive development which has become the standard in the United States, Europe, and most other Western countries (Hunt, 1982). The theory looks at cognitive growth as a series of qualitative changes that occur in a child's thinking (Ammon, 1977) and describes these differences in terms of stages. Children pass from stage to stage through processes which Piaget calls assimilation, adding new information, and accommodation, changing present cognitive structures so that new information fits (Lavatelli, 1973).

This theory of cognitive development places the primary and preschool child in the preoperational stage. Preoperational children, according to Piaget, are beginning to organize objects and information by classifying, seriating or ordering based on physical characteristics, and by structuring time and space. Further, these young children are assumed to be functioning on a concrete level and, although beginning to use symbols, unable to make strictly mental manipulations (Lavatelli, 1973). Preoperational children are very intuitive (Weikert, 1974), their cognitive abilities limited by their ability to focus only on one physical characteristic at a time, a behavior called centering. Further, children between the ages of four and seven, Piaget states, have "...few intuitions capable of articulation" and are incapable of "generalization and reversibility" (1962, p.233). Only when children begin to move into a transitional stage, a period linking the preoperational and concrete operational stages, are they able to consider multiple aspects of a situation and to consider relations among stimuli (White, Alexander, & Fuqua, in press).

PIAGET'S THEORY AND TEACHER EDUCATION

Because Piaget is "...the most widely known name in research of the development of human thinking and cognition" (Hittleman, 1978, p.52), it is not surprising that he has had a great impact on the content of courses preparing elementary teachers. An informal review of 35 textbooks used in undergraduate teacher education programs revealed that Piaget's contributions are touched upon in educational psychology and early childhood introductory courses and science, social studies, math, and reading methods courses. Of these 35 texts, 29 discussed Piaget's theory, most focusing on the stages and characteristics of children falling within each of these stages.

Descriptions of the preoperational child revealed such terms as confused (Hildebrand, 1975; Seefeldt, 1977), erratic and inconsistent (Jackson, Robinson, & Dale, 1977), irrational and illogical (Carin & Sund, 1980), disorganized, inaccurate and incomplete (Seefeldt, 1977). Seefeldt (1977) states that to preoperational children

"...a red square is red; therefore, it cannot be a square" (p.18), and warns of the danger of presenting concepts too early.

The picture that emerges is one of a young child extremely limited in reasoning ability (Blank, Rose, & Berlin, 1981); a child who is basically "cognitively inept" (Gelman, 1979, p.902). This view of the young child, ages two to seven, becomes especially significant when it is presented to undergraduate education majors over and over in their teacher preparation program.

A few examples may suggest some of the thinking which might result from this. Experience with undergraduate students going through a microteaching program revealed that students preparing to teach kindergarten felt that higher order questions were inappropriate for five-year olds. They viewed five-year olds as unable to analyze, synthesize and evaluate information and situations. To another student, one semester away from kindergarten student teaching, asking for approaches to classroom management, it was suggested that children be provided with alternatives and be allowed to choose between them. The student was surprised and skeptical of the suggestion, for in one of her courses she had learned that "five-year olds can't make decisions."

Whether or not we intend for undergraduate students to interpret the information presented in this way, the picture they are getting is one of a child of limited cognitive ability. These preservice teachers then interpret this as an inability to think and to make decisions. Although several authors point out that children progress through the stages at different rates, this point is not stressed. Rather, characteristics of each stage, for which Piaget is probably most well-known (Hunt, 1982), seem to be most prominent.

NEO-PIAGETIAN RESEARCH

The overriding image of the preschooler being presented to undergraduates, then, is one of a very dependent, illogical and irrational creature. In fact, the characteristics of four- and five-year olds may be much broader, their cognitive skills much more sophisticated and the ages at which these skills appear much more varied than is implied by the literature.

Some of those questioning Piaget's theory wish to reject it as "more of a hindrance than a help" (Hunt, 1982, p.210) in understanding cognitive development. Others, calling themselves neo-Piagetians, are examining the stages and suggesting, not that they do not exist, but that they may be much less "simple and straight forward" (Flavell, 1971, p.45), with much more heterogeneity within each stage than was previously suggested (Flavell, 1982; Kitano, 1982). Researchers like Pascual-Leone (1969), Flavell (1982), Fischer (1980), Gelman (1979), Vosinadou and Ortony (1983) are adding to the theory. Their research is showing heterogeneity within each stage and heterogeneity within each child (Noddings, 1983), and is indicating that a child may perform differently on different types of tasks. They are demonstrating the presence of abilities in young children which, according to Piaget, should not be present at all (Hunt, 1982).

Richards and Siegler (1981) supported this trend in their research which found three- to five-year olds able to adopt problem-solving strategies and apply rules when working with familiar objects in familiar settings. Blank, Rose and Berlin (1981) found

some three-year olds able to solve prediction problems, some four-year olds able to not only solve prediction problems but to explain their strategies, and many five-year olds capable of solving and explaining prediction problems. Others have looked at specific strategies among young learners (Brown, 1977; Flavell, 1981; Garner, 1981) and at the acquisition of these strategies (Brown, Bransford, Ferrara, & Campione, 1982).

ANALOGICAL REASONING IN YOUNG CHILDREN

The present study adds to the neo-Piagetian literature with an investigation of four- and five-year olds' analogical reasoning ability. Analogical reasoning was selected because research has associated it with reading performance (Alexander & White, 1983; Rumelhart & Ortony, 1977; Sternberg, 1977), has demonstrated its trainability among school-aged children (Alexander, White & Mangano, 1983), and has shown its utility in linking knowledge learned in one domain with knowledge learned in another (Vosniadou & Ortony, 1983).

It is also important to look at analogical reasoning abilities specifically in young children. Vosniadou and Ortony (1983) noted that analogies are almost completely absent from elementary textbooks. This may be because preoperational children and those in transition to the concrete operational stage (approximately 2 to 7 years old) are assumed to be unable to decenter (Piaget, 1962), to consider multiple characteristics and unable to do the "if-then" thinking necessary to analogical processes (Carin & Sund, 1980). Gentner's (1977) research, however, suggests that young children may be able to apply analogies as well or better than do adults.

The current study incorporates the component processes of analogical reasoning as outlined by Sternberg (1977) into a game-like format using familiar materials, as suggested by Celman (1979), to further assess analogical reasoning ability in four- and five-year olds. Specifically, the investigation tested the following questions:

1. Is there evidence of analogical reasoning in four- and five-year olds as demonstrated by their performance on an analogy task?
2. Are there differences in the performance of four- and five-year olds on the analogical reasoning task?

METHOD

Subjects

Twenty children, 10 four-year olds and 10 five-year olds, were randomly selected from a group of children enrolled in a private, church-affiliated day school in College Station, Texas. The four-year olds ranged in age from 4.2 to 4.10, with a mean age of 4.5. The five-year olds ranged in age from 5.0 to 5.8 with a mean age of 5.6. Twelve males and 8 females were tested.

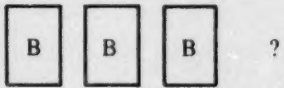
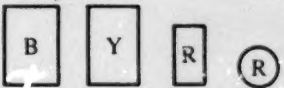
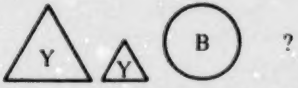
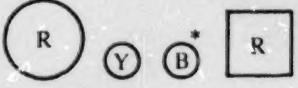
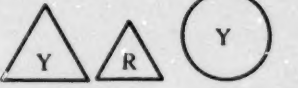
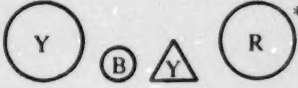
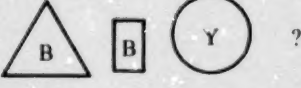
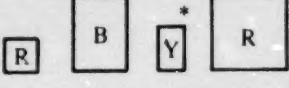
Materials

Colored attribute blocks, common to preschool and primary classrooms, varying

along the dimensions of color, shape, and size were used. A four-inch by 24-inch gameboard, consisting of four white-framed boxes, separated into pairs by a white divider was designed for the task.

The analogy "game" consisted of 16 items of increasing complexity. For each item, the investigator placed two blocks in the first two squares of the gameboard and a third block in the third square. Four blocks were then placed along one side of the gameboard. These blocks, from which the child made a selection to complete the analogy, included the correct choice, a block differing by one attribute, one differing by two attributes and one differing by three attributes. Several test items are illustrated in Figure 1.

Figure 1
ANALOGICAL REASONING TASKS

Item No.	Item*	Choices**
1		
3		
7		
13		

*B = blue, Y = yellow, R = red

**Choices presented to children were in a vertical format.
The correct response for each item is starred.

Procedures

Each child was individually tested by one of the investigators, while another coded verbal and non-verbal behaviors and another videotaped the session. Testing took place in a classroom close to the child's room and time was taken prior to the testing to establish rapport, inform the child about the equipment and other persons in the room, and put the child at ease. The following directions were then provided to each child:

Today, we will be playing a game and in this game we have a gameboard (pointing to the board) and different pieces that go on the board (holding up attribute blocks). When we play the game, I am going to take different pieces and put them on the board like this (holding up blocks used in item one). Each time we play the game I am going to put a piece here (inserting block in first box), here (placing block in second box), and here (inserting block in third box), but I am not going to put a piece here (indicating the fourth box). What you have to do is to choose the piece from over here (pointing to the choices vertically arranged at the right) that you think should go in this box (pointing to the fourth box). Now, the way you decide is to look at this piece (first block), and this piece (second block) and see how they go together. Then, you look at this piece (third block) and find the piece from over here (pointing to the choices) that goes with this one (third block) the way these two (first and second blocks) go together.

Directions to attend to the relationship of the first two blocks in making their selection were repeated between each item. No other cues were given. After a selection was made, the child was asked to explain the choice and why various other blocks were not selected.

Results

In response to the research question, test results indicated analogical reasoning abilities to be present in four- and five-year olds. Two children responded correctly to all 16 items, while another answered 15 of the 16 items correctly. For this task, these children appear to be performing at a concrete operational stage.

Other children demonstrated performance characteristic of children in transition from the preoperation to the concrete operational stage. Four of the four-year olds and two of the five-year olds responded correctly to 11 of the 16 items, indicating an ability to attend to relationships across pairings. For those children demonstrating centering behaviors, characteristic of Piaget's preoperational stage, color appeared to be the most salient attribute. Abilities to explain choices varied considerably, even among those demonstrating analogical thinking. Raw scores, means, and standard deviations for four- and five-year olds on the analogy task appear in Table 1.

These results counter research of Piaget, Montangero, and Billeter (1977) which suggested that analogical reasoning develops from about eight to 11 years of age and that only children around 11 years of age can explain their reasoning.

Data analyzed with respect to the second research question indicated a difference in the performance of four- and five-year olds, and a significantly greater range of scores for five-year olds than for four-year olds.

IMPLICATIONS FOR TEACHER EDUCATION

It seems essential that research on the cognitive capabilities in young children be

Table 1
RAW SCORES, MEANS, AND STANDARD DEVIATIONS
FOR 4 AND 5 YEAR OLDS ON THE ANALOGY TASK

	Four Year Olds	CA	Five Year Olds	CA
RAW SCORES	11	4-9	16	5-8
	11	4-10	16	5-5
	11	4-9	15	5-6
	10	4-2	11	5-0
	9	4-10	11	5-6
	8	4-5	8	5-2
	7	4-4	8	5-3
	7	4-9	7	5-7
	7	4-6	6	5-8
	6	4-8	6	5-6
MEAN	8.70		10.40	
SD	1.95		4.03	
VARIANCE	3.80		16.03	

continued, thereby replicating findings of previous studies and expanding our understanding of thinking and reasoning abilities of this special population. For example, in a study presently underway (Alexander, Willson, White, & Fuqua, 1984), preliminary data replicate the findings of the current investigation by providing evidence of analogical reasoning abilities in four- and five-year olds.

What existing neo-Piagetian research does suggest is that Piagetian stage theory may not provide the definitive framework for determining the cognitive potential of young children. Rather, the characteristics and capabilities of young children, ages two to seven, may be much more variable than previously thought. Educators need to know that some children, on some tasks, presented in certain ways, are capable of solving problems previously thought to be too complex or inappropriate.

As the survey of undergraduate methods texts indicated, students are repeatedly exposed to the theory of Piaget, with an emphasis on the stages and characteristics of children in each stage. This exposure cannot help but influence preservice and inservice teachers' expectations of young children, which in turn may limit instructional approaches used in early childhood classrooms. In a reiteration of the Pygmalion effect, if teachers act toward young children in accordance with limited expectations, then children will begin to appear more homogeneous than they really are. In other words, the cognitive potential of young children must be stressed in teacher education rather than presented as after thoughts as does Seefeldt who, after a restrictive description of the preoperational child, offhandedly notes that these children, "however . . . do use the processes of thinking" (1977, p.234).

Neo-Piagetian research on young children must become an essential component in early childhood/elementary education programs. Preservice teachers need to be ex-

posed to the neo-Piagetian literature that demonstrates young children's potential for higher level thinking. These future teachers need to understand that they are likely to encounter preschoolers who function beyond the preoperational level. They need to see the "big picture" in cognitive development so that they can assist those children who are ready to progress, to think, to experiment, and to discover relationships. They should be made aware that some five-year olds do know that a red square is both red and a square. They need to know that many higher level concepts presented appropriately are valid for preschoolers, and may not be as incomprehensible for the child and as "futile" for the teacher as some (e.g., Morrison, 1980) would lead us to believe.

If instruction is to be positively affected, however, materials and strategies employed in the instruction of young children must be reevaluated in light of our increasing understanding of the cognitive capability of the preschool population. Materials and strategies widely used in our preschool and primary schools may well prove less than challenging to many young children who possess higher-order reasoning abilities. Further, teachers need to be presented with specific methods and materials that would be effective in teaching reasoning skills to young children. To illustrate, higher-order questioning skills should be emphasized. Also, techniques for assessing and teaching reasoning skills to children need to be developed, employing tasks which are ecologically-valid (i.e., familiar to and appropriate for the age and interests of the students).

All these implications become even more crucial when one considers the vast number of young children participating in pre-Kindergarten programs. If the present trend continues, more and more two-, three- and four-year olds will be spending a portion of the work-day in some form of pre-Kindergarten program. Various states, Texas among them, are even considering legislation that would mandate academic programs for pre-Kindergarten children (Select Committee on Public Education, 1984).

It becomes clear that teacher education must begin now to develop quality programs that will produce instructors who possess an accurate understanding of the cognitive potential of young children and who are able effectively to meet the needs of these children. It is also clear that such quality programs must incorporate a more flexible view of thinking and reasoning abilities of young children than that which is generally being espoused. If they are to prove successful, programmatic changes must begin with a recognition that young children, far from being "cognitively inept", are "cognitive capable" learners worthy of the attention of teacher education.

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¹A complete listing of the texts reviewed in this study is available upon request from the first author.